

Name (PRINT): _____

*In order to receive credit for the exam, this question booklet (all pages) must be turned in at the end of the exam WITH YOUR NAME **LEGIBLY PRINTED** ON IT. Note that only responses marked on the answer sheet will be counted (make sure question and answer numbers match). If you feel a question is unfair or ambiguous or has more than 1 right answer, write the question # and your reasons on the **BACK OF THE LAST PAGE** of the booklet. This exam is supervised by trained proctors and conducted in accord with MCO standards on student conduct.*

Choose the BEST answer.

1. Fibers of the lateral lemniscus:
 - A. May derive from cochlear nucleus neurons
 - B. May be continuous with auditory nerve fibers
 - C. Terminate primarily in the medial geniculate nucleus
 - D. May decussate at the pyramidal decussation
 - E. All of the above
2. The organ of Corti contains:
 - A. Cholinergic synapses
 - B. Peripheral processes of spiral ganglion cells
 - C. Hair cells
 - D. Axons of neurons with somata in the superior olivary complex
 - E. All of the above
3. Of the following, the most important factor in transmission of sound pressure vibrations from the external to the inner ear is:
 - A. Ratio of cross-sectional areas of tympanic and oval window membranes
 - B. Middle ear reflex
 - C. Middle ear fluid vibrations
 - D. Movements of the malleo-stapedial joint
 - E. Vibration of the cupula
4. Neurons with cell bodies in the most apical part of the spiral ganglion:
 - A. Form synaptic terminals in the most dorsal parts of the superior olivary complex
 - B. Are activated best by high frequency tones
 - C. Form synapses with as many as 1000 inner hair cells
 - D. Project only to fusiform cells of the cochlear nucleus
 - E. Have spontaneous firing of action potentials in the absence of sound
5. Entry of potassium ions into hair cells of the inner ear:
 - A. Increases when cilia are bent in the direction of the shorter cilia
 - B. Leads to hyperpolarization of the membrane potential
 - C. Occurs down a steep concentration gradient
 - D. Occurs down an electrical gradient
 - E. All of the above

6. Which neurons of the cochlear nucleus have broad tuning curves and large dendrites oriented perpendicularly to the trajectory of auditory nerve fibers?
 - A. Spherical bushy cells
 - B. Octopus cells
 - C. Fusiform cells
 - D. Granule cells
 - E. Purkinje cells
7. Which of the following is **NOT** a feature of information processing in the inferior colliculus and medial geniculate nucleus:
 - A. Tonotopic organization
 - B. Sound loudness coded especially by numbers of active neurons
 - C. Sound frequency for high frequency sounds coded especially by rate of neural firing
 - D. Coding of spatial localization of sound sources
 - E. Centrifugal, feedback pathways
8. A region or nucleus which receives a major projection from the vestibular nuclei is:
 - A. Dentate nucleus of cerebellum
 - B. Trochlear nucleus
 - C. Putamen
 - D. Superior olivary complex
 - E. Spinal trigeminal nucleus
9. Excitation in the semicircular canals is most closely related to:
 - A. Relative movements of otoliths and gelatinous material
 - B. Elevation of chloride concentration in hair cells
 - C. Bending of hair cell cilia away from the kinocilium
 - D. Mixing of endolymph and perilymph
 - E. Fluid inertia
10. In testing vestibular function by the caloric test:
 - A. The subject's eyes are open so that eye movements can be watched
 - B. The subject may lay on foam to decrease somatosensory input
 - C. The subject's head is tilted forward 30° to bring the horizontal semicircular canal into a vertical orientation
 - D. Cold water is irrigated into both ears simultaneously
 - E. All of the above
11. Which of the following involves a fluctuating sensorineural hearing loss, most often for low frequencies:
 - A. Perforation of tympanic membrane
 - B. Presbycusis
 - C. Ménière's disease
 - D. Otitis media
 - E. Ototoxicity

12. Which of the following involves fluid in the middle ear:
- A. Otosclerosis
 - B. Presbycusis
 - C. Ménière's disease
 - D. Otitis media
 - E. Ototoxicity
13. Tinnitus may be a symptom of:
- A. Noise damage
 - B. Ototoxicity
 - C. Ménière's disease
 - D. Eighth nerve tumor
 - E. All of the above
14. A brain region which does **NOT** receive innervation from the olfactory bulb is:
- A. Anterior olfactory nucleus
 - B. Piriform cortex
 - C. Putamen
 - D. Entorhinal cortex
 - E. Amygdala
15. Neurons of the olfactory bulb which release GABA as transmitter are:
- A. Mitral cells
 - B. Granule cells
 - C. Spherical bushy cells
 - D. Pyramidal cells
 - E. Tufted cells
16. Anosmia or hyposmia:
- A. May occur during a viral infection of the nose
 - B. May result from head injury
 - C. May occur during aging
 - D. May be temporary
 - E. All of the above
17. A major connection of the gustatory system is:
- A. Piriform cortex to contralateral amygdala
 - B. Solitary nucleus to ipsilateral ventral posteromedial nucleus of thalamus
 - C. Inferior colliculus to contralateral insula
 - D. Cerebellar nodulus to ipsilateral hypoglossal nucleus
 - E. Lateral geniculate nucleus to superior colliculus
18. The time for regeneration of taste receptor cells is closest to:
- A. 10 minutes
 - B. 10 hours
 - C. 10 days
 - D. 10 months
 - E. none of the above since taste receptors don't regenerate

19. Action potentials in chorda tympani nerve fibers:
 - A. Propagate to the brain at very high speeds, such as 100 meters per second
 - B. Vary in amplitude depending on tastant concentration
 - C. Lead to transmitter release in the superior olivary complex
 - D. May result from activity in about 5 different taste buds
 - E. Occur only in response to sweet tastants
20. Gamma motor neurons...
 - A. Use glutamate as a transmitter
 - B. Have the most rapidly conducting axons of all the motor neurons
 - C. Control the sensitivity (or gain) of muscle spindles
 - D. Control the sensitivity (or gain) of the Golgi tendon organs
 - E. Control the sensitivity (or gain) of Pacinian corpuscles
21. Alpha motor neurons ...
 - A. Use glutamate as a transmitter
 - B. Have the most rapidly conducting axons of all the motor neurons
 - C. Control the sensitivity (or gain) of muscle spindles
 - D. Control the sensitivity (or gain) of the Golgi tendon organs
 - E. Control the sensitivity (or gain) of Pacinian corpuscles
22. Short propriospinal fibers (S-PF) and long propriospinal fibers (L-PF) differ mainly in which respect (besides in their lengths)?
 - A. S-PF are axons of motor neurons; and L-PF are axons of interneurons
 - B. L-PF are axons of motor neurons; and S-PF are axons of interneurons
 - C. S-PF mainly project to proximal muscle-motor neurons pools and L-PF project to distal motor neurons pools.
 - D. S-PF mainly project to distal muscle motor neurons pools and L-PF project to proximal motor neurons pools.
 - E. L-PF are inhibitory and S-PF are excitatory
23. Which of the following conditions would typically result in, or be associated with, an increment in force exerted by A MUSCLE during a voluntary movement.
 - A. recruitment of increasingly greater numbers of motor units
 - B. recruitment of larger motor units before smaller ones
 - C. recruitment of fast-fatigueable motor units before slow-non-fatigueable units
 - D. increasing the number of synaptic vesicles releasing acetylcholine in response to an individual action potentials at the neuromuscular junction
 - E. recruitment of increasing numbers of Renshaw cells
24. Which of the following conditions would typically result in an increment in force exerted by A SINGLE MUSCLE FIBER during a voluntary movement.
 - A. recruitment of increasingly greater numbers of alpha motor neurons
 - B. recruitment of increasingly greater numbers of Renshaw cells
 - C. activation of Golgi tendon organs at the tendon connected to this muscle fiber
 - D. increasing the frequency of action potentials arriving at the neuromuscular junction
 - E. increasing the number of synaptic vesicles releasing acetylcholine in response to an individual action potentials at the neuromuscular junction

25. Complete occlusion of the anterior spinal artery at CERVICAL LEVELS would probably damage which of the following descending spinal pathways?
- A. lateral corticospinal tract
 - B. pontine reticulospinal tract
 - C. medial corticospinal tract
 - D. lateral vestibulospinal tract
 - E. all of the above
26. Complete occlusion of the anterior spinal artery at LUMBAR LEVELS would probably inflict the **LEAST** damage on which of the following descending spinal pathways?
- A. anterolateral (spinothalamic) tract
 - B. pontine reticulospinal tract
 - C. medial corticospinal tract
 - D. lateral vestibulospinal tract
 - E. tectospinal and medial vestibulospinal tracts
27. Which of the following components of the nervous system is **UNNECESSARY** for a flexion reflex to occur?
- A. Primary afferent fibers of the C and/or A-delta type.
 - B. Lateral corticospinal tract axons
 - C. Spinal cord interneurons that project to the contralateral anterior horn
 - D. Alpha motor neurons
 - E. Spinal cord interneurons that contain GABA or glycine
28. Which of the following reflex components involves a monosynaptic pathway?
- A. Spindle IA afferents onto homonomous (same) muscle alpha motor neurons
 - B. Spindle II afferents onto homonomous muscle gamma motor neurons
 - C. Golgi tendon organ IB afferents onto homonomous muscle alpha motor neurons
 - D. Golgi tendon organ IB afferents onto antagonist muscle alpha motor neurons
 - E. Spindle IA afferents onto antagonist muscle alpha motor neurons
29. Which pair of terms best fits the sentence: When extrafusal muscle **CONTRACTION** occurs, _____ receptors DECREASE their activity along the _____ class of nerve fibers.
- A. muscle spindle, IA
 - B. muscle spindle, IB
 - C. cutaneous nociceptor, IV
 - D. Golgi tendon organ, IB
 - E. Golgi tendon organ, II

Select from the following list the best answers to the next 4 questions; an answer may be used once, more than once or not at all.

- a. supplementary motor cortex (area 6-medial)
- b. premotor cortex (area 6-lateral)
- c. motor cortex (area 4)
- d. parietal cortex, including postcentral gyrus (areas 1, 2, 3b) and posterior parietal cortex (areas 5 and 7)
- e. all of the above

30. Which motor cortical area has (at least some) direct connections to alpha motor neurons?

31. Which cortical motor area receives basal ganglia (GP_i) output via the VL thalamus and is involved in the organization of complex sequences of movement?

32. Which cortical area is the source of axons that travel into the spinal cord?

33. Which cortical region is a source of corticospinal tracts and also functions as primary and higher level somatosensory cortex?

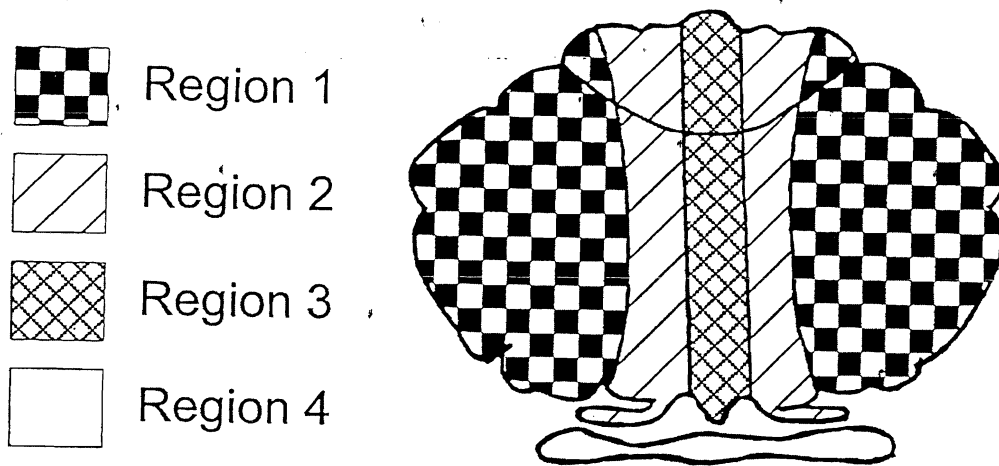
Choose the best answer

34. Cerebellar damage in a patient with a history of heavy alcohol use might initially present with which of the following?

- A. rapid pressured speech
- B. tremor at rest
- C. increased muscle tone
- D. increased resistance to passive movement
- E. wide based gait

Continue on next page

Use the following drawing of the anterior lobe, posterior lobe, and flocculonodular lobe of the cerebellum to answer the next 4 questions.



35. A patient with cerebellar disease localized to Region 1 would most likely exhibit difficulty in which of the following?
- balance
 - speech
 - maintenance of muscle tone
 - remembering sequences of numbers
 - walking (or synchronous limb movements if body otherwise supported)
36. A patient with cerebellar disease localized to Region 4 would most likely exhibit difficulty in which of the following?
- balance
 - speech
 - maintenance of muscle tone
 - maintenance of steady grip on an object placed in hand
 - walking (or synchronous limb movements if body otherwise supported)
37. Which of the following cerebellar regions receives extensive synaptic input from the spinocerebellar tracts?
- 1 only
 - 4 only
 - 2 + 3 only
 - 2 + 4 only
 - All Regions
38. Which of the following cerebellar regions projects to the red nucleus and thalamic VL nucleus via their deep cerebellar nuclei?
- 1 only
 - 4 only
 - 2 + 3
 - 2 + 4
 - 1 + 2

Choose the best answer

39. The most complete list of structures composing the STRIATUM is:
- A. globus pallidus, subthalamic nucleus, putamen and thalamus
 - B. putamen, globus pallidus, substantia nigra, superior colliculus
 - C. amygdala, putamen, olfactory tubercle, nucleus accumbens, caudate
 - D. subthalamic nucleus, substantia nigra, caudate, putamen
 - E. pallidum, pontine nuclei, subthalamic nuclei, substantia nigra, caudate
40. The principle neurotransmitters/neuropeptides involved in the major anatomical pathways of the basal ganglia include:
- A. glutamate, aspartate, glycine, serotonin, vasopressin and histamine
 - B. dopamine, acetylcholine, GABA, substance P, glutamate and enkephalin
 - C. norepinephrine, dynorphin, acetylcholine, dopamine, aspartate and GABA
 - D. dopamine, bradykinin, norepinephrine, serotonin, glutamate and glycine
 - E. GABA, dopamine, neurotensin, glutamate, serotonin, and norepinephrine
41. The main clinical presentation of Parkinson's disease includes:
- A. bradykinesia, postural instability, resting tremor, rigidity
 - B. dyskinesia, choreiform movements, motor tics, dementia
 - C. tremor, dystaxia, dementia, dysequilibrium, dysautonomia
 - D. supranuclear gaze palsy, postural tremor, psychosis, incontinence
 - E. proprioceptive loss, spasticity, hyperreflexia, Babinski signs
42. Relatively speaking, once activated, the direct pathway leads to:
- A. increased neuronal firing in the GPi and increased inhibition of the thalamus
 - B. decreased neuronal firing in the GPi and decreased inhibition of the thalamus
 - C. increased neuronal firing of the STN and decreased excitation of the thalamus
 - D. increased inhibition of the GPe and decreased inhibition of the thalamus
 - E. decreased inhibition of the GPe and increased inhibition of the thalamus
43. In Parkinson's disease the absence of dopamine from the substantia nigra, pars compacta results in:
- A. overactivity of the thalamus due to excessive inhibition of the GPi/SNr complex
 - B. deficiency of glutamatergic stimulation from the cortex into the putamen
 - C. inhibition of cortical pathways through increased direct pathway and decreased indirect pathway activities
 - D. inhibition of the thalamus due to subthalamic overactivity and diminished GABA input converging at the GPi
 - E. overstimulation of the GPe resulting in excessive inhibition of the GPi which, in turn, overly inhibits the thalamic nuclei

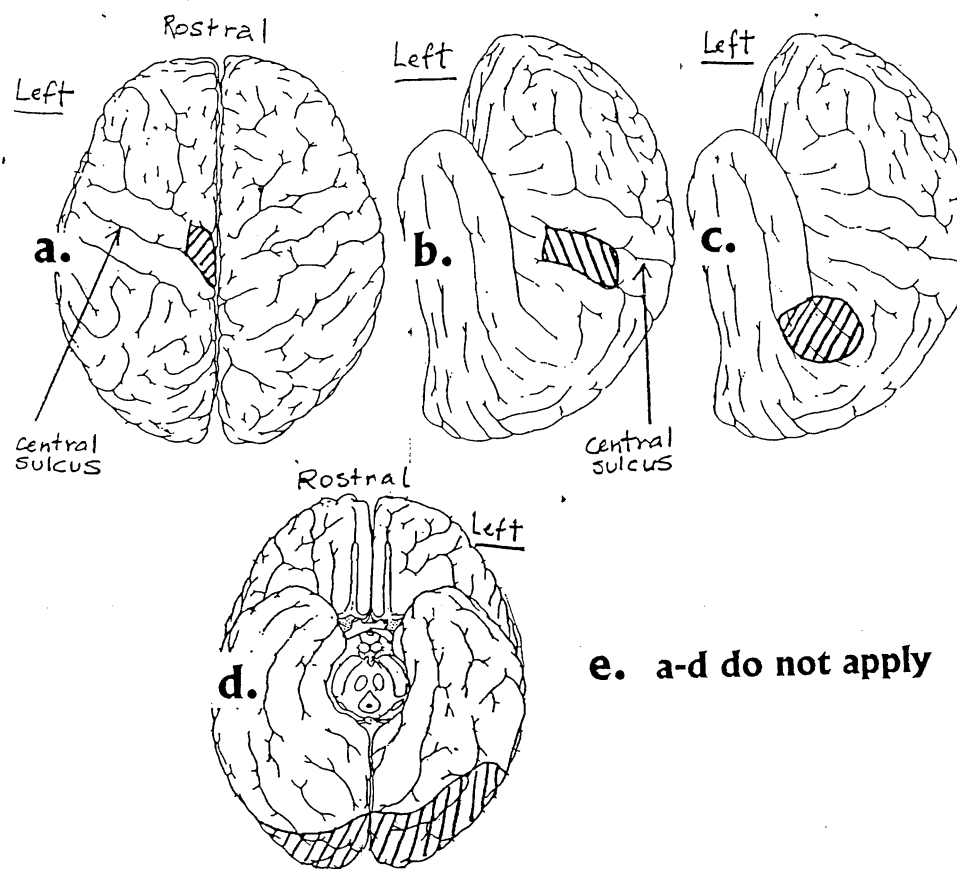
44. A 60 year old man presents to the Emergency Department within 60 minutes of sudden onset of profound left sided weakness and numbness. You take the history and examine him and decide he may be a good candidate for thrombolytic therapy, but before treating him you need which test?
- A. Brain CT scan
 - B. Echocardiogram
 - C. TPA Antigen level
 - D. Chest X-ray
 - E. Lumbar puncture
45. While sitting in a chair, a 65 year old woman experiences heart palpitations followed by acute weakness of the right arm more so than leg and inability to speak. When her son finds her, her systolic blood pressure is 185 mmHg and her eyes are looking to the right. The most likely etiology of this stroke syndrome is...
- A. Clot in the left Middle Cerebral Artery
 - B. Left Posterior communicating artery aneurysm rupture
 - C. Hemorrhage in the left cerebellar hemisphere
 - D. Clot in the left Anterior Cerebral Artery
 - E. Clot in right Internal Carotid Artery
46. All of the following are risk factors for ischemic stroke **EXCEPT**:
- A. Hypertension
 - B. Atrial Fibrillation
 - C. Moderate alcohol use
 - D. Smoking
 - E. Migraine
47. A patient with an epidural hematoma must have...
- A. an injury to bridging veins
 - B. a contra-coup lesion
 - C. an impact injury to the head
 - D. hypersexuality from involvement of the temporal lobe
 - E. a long pulse-duration inertial load
48. Contusions most commonly occur...
- A. In the occipital area
 - B. In the fronto-temporal areas
 - C. In association with rupture of the middle meningeal artery
 - D. In small monkeys forced to ride on sleds
 - E. In the periventricular white matter
49. Bitemporal traumatic brain injuries may cause
- A. Disorders of olfaction
 - B. Diplegic motor disorders
 - C. Kluver-Bucy syndrome
 - D. Lack of initiation
 - E. Tactile discrimination deficits
50. A major epidemiological factor in traumatic brain injuries is:

50. A major epidemiological factor in traumatic brain injuries is:
- A. Motor vehicle accidents in the elderly and small child.
 - B. Female gender and inner city violence
 - C. Sporting events in young males
 - D. Alcohol and substance abuse
 - E. Bunge jumping
51. Which of the following areas does **NOT** have a direct connection with the hypothalamus?
- A. Amygdala
 - B. Retina
 - C. Olfactory areas
 - D. Brainstem cranial nerve nuclei
 - E. Cerebellum
52. Hypothalamic nuclei located in the periventricular region would most likely be involved with which of the following functions?
- A. Mediation of emotion
 - B. Temperature regulation
 - C. Sexual behavior
 - D. Control of growth hormone release
 - E. Integration of visceral afferent information
53. Which of the following is an example of short loop feedback?
- A. Growth-hormone releasing hormone action on neurons of the periventricular nucleus
 - B. ACTH action on cells of the zona fasciculata
 - C. Cortisol action on corticotropes of the anterior pituitary gland
 - D. TSH action on follicular cells of the thyroid
 - E. LH action on the gonadotropes of the anterior pituitary gland
54. Which of the following would **NOT** occur following the binding of ACTH to the membrane of an adrenal fasciculata cell?
- A. Increased levels of free intracellular cholesterol
 - B. Increased levels of cAMP
 - C. Activation of protein kinase A
 - D. Increase in transcortin
 - E. Increase production of pregnenolone
55. You see a patient in the Neurology clinic who is experiencing increase in weight and complains that he "is always hungry". MRI confirms a lesion of the ventral diencephalon.. Which of the following is the most likely location for a hypothalamic tumor in this patient?
- A. Periventricular zone of the hypothalamus
 - B. Medial hypothalamic zone
 - C. Lateral hypothalamic zone
 - D. Mammillary body
 - E. Lamina terminalis

56. One of the mechanisms underlying the DECREASED heat loss that occurs in the acute response to cold is...
- A. decreased appetite for protein
 - B. vasodilation of core blood vessels
 - C. shivering
 - D. vasoconstriction of skin blood vessels
 - E. decreased appetite for carbohydrate
57. During a strenuous run in hot, humid weather, a man begins to stumble, run erratically and leans to one side. He complains of headache before he collapses. In the emergency room, his skin is hot and dry to the touch; his body temperature is 105° F. The most likely diagnosis is
- A. heat stroke
 - B. heat exhaustion
 - C. heat cramps
 - D. febrile illness of unknown origin
 - E. accidental hypothermia
58. The human thermoregulatory system is described as having feedforward capabilities because skin thermoreceptors
- A. are more dense on the hands and feet than on the legs and arms
 - B. signal that a change in core temperature may occur later in time
 - C. signal that a change in core temperature has already occurred.
 - D. respond more accurately to cold temperatures than to hot temperatures
 - E. signal that a change in peripheral (shell) may occur later in time
59. Lesions in this region of the hypothalamus produce aphagia and stimulation produces increased desire for food
- A. ventromedial nucleus
 - B. preoptic area
 - C. posterior area
 - D. lateral area
 - E. anterior nucleus
60. REM sleep is characterized by all of the following **EXCEPT**:
- A. Low voltage fast activity on EEG
 - B. PGO spikes
 - C. Increased muscle tone
 - D. Rapid eye movements
 - E. Dreaming
61. Diagnostic features of stage II sleep is the presence of:
- A. Alpha activity
 - B. Loss of muscle tone
 - C. Vertex sharp wave
 - D. Sleep spindles
 - E. Delta waves

62. REM sleep is characterized by activity of:
- A. Dopaminergic neurons
 - B. Cholinergic neurons
 - C. GABA-ergic neurons
 - D. Serotonergic neurons
 - E. Norepinephrine containing neurons
63. EEG activity is generated by:
- A. Action potentials of horizontally oriented interneurons of the cerebral cortex
 - B. Individual action potentials from pyramidal cells
 - C. Excitatory post synaptic potentials (EPSP) and inhibitory post synaptic potentials (IPSP) of vertically oriented pyramidal cells of the cerebral cortex
 - D. IPSPs of off pyramidal cells in the cerebellum
 - E. Far field potentials from corticospinal tract
64. EEG is most useful in confirming diagnosis of:
- A. Stroke
 - B. Multiple sclerosis
 - C. Peripheral neuropathy
 - D. Epilepsy
 - E. Headaches
65. Circadian rhythm is regulated by:
- A. Subthalamic nucleus
 - B. Ascending reticular activating system
 - C. Hippocampus
 - D. Caudate nucleus
 - E. Suprachiasmatic nucleus
66. Which of the following statements best describes a typical sodium amytal test result in a right-handed person?
- A. loss of motor functions on the left side when the left carotid is injected
 - B. loss of speech when the right jugular is injected
 - C. complete loss of hearing when either carotid is injected
 - D. loss of speech when the left carotid is injected
 - E. no functional losses when either carotid is injected
67. Which of the following best identifies the major cortical areas that generate, respectively, visual perceptions; somatosensory perceptions; speech; and creative thinking?
- A. parietal; temporal; occipital; frontal pole
 - B. temporal; occipital; frontal; parietal near the precuneus
 - C. occipital-temporal; parietal; frontal near the lateral fissure; and frontal pole
 - D. occipital; parietal; occipital; temporal near the parahippocampal gyrus
 - E. occipital; parietal; occipital-temporal gyri; temporal pole

Select which choice (a-e, cross hatched regions indicate a lesion) most appropriately accounts for the deficits indicated in the neurological exams of the patients described in the following 4 questions. Assume that all deficits are attributable to a cortical lesion.



e. a-d do not apply

68. The patient is a 60 year old man who said he passed out early this morning and awoke to find he had trouble moving his foot. A preliminary neurological exam indicated he had only very limited ability to move his right toes, ankle, and leg. Other neurological tests were normal. He has no previous history of neurological problems.

69. The patient is a right-handed, highly intelligent student who was involved in a car accident which resulted in a blow to the left side of the head. Since the accident she has had difficulty understanding people when they speak to her. Her hearing and vision are normal and she has no other history of neurological problems.

70. The patient received a small caliber gun shot wound to the head. There was little bleeding, but neurological tests in the emergency room indicated a loss of touch and pin prick sensations in the left forelimb and hand. All other tests were normal.

71. The patient is a 75 year old woman who has a history of low blood pressure. Her daughter said she fainted and was unconscious for about 15 minutes. Upon reaching the emergency room, she regained consciousness but had no recall of what happened. Upon questioning she does not remember her name or what day it is, and does not recognize her daughter. Other neurological signs appear normal. These, but no other, deficits persisted and were present upon her discharge 4 days later.

72. Which of the following statements about cortical functions is **FALSE**?
- A. mental functions involve activation of many neurons across multiple areas of cortex
 - B. the hippocampus and adjacent temporal cortex contribute to memory
 - C. in an awake, conscious state, cortex is characterized by a synchronized EEG with high amplitude, low frequency waves
 - D. all cortical functions are performed by only two types of cortical neurons (granule and pyramidal)
 - E. cortical areas that generate motor, somatosensory, auditory, and language functions usually have six layers of neurons
73. Which of the following statements is **NOT** consistent with the dopamine hypothesis of schizophrenia?
- A. this disease involves abnormal dopamine activity in limbic areas
 - B. prefrontal cortical areas normally inhibit limbic cortical areas
 - C. treatment of schizophrenia requires drugs that amplify dopamine activity in limbic cortex
 - D. schizophrenia involves abnormally high dopamine activity in the mesolimbic pathway
 - E. dopamine release from ventral tegmental neurons is important in this disease
74. Which of the following statements does **NOT** apply to declarative memory?
- A. it involves knowledge of facts
 - B. it is at a conscious level and can be expressed verbally
 - C. it can be established in one or a few learning trials
 - D. it involves memories required for motor skills
 - E. it involves memories of events
75. All the following structures are thought to contribute to semantic memories of facts **EXCEPT**:
- A. parahippocampal cortex
 - B. hippocampus
 - C. entorhinal cortex
 - D. frontal lobe areas
 - E. superior colliculus
76. The mechanisms for long-term potentiation of synapses in the hippocampus involve all the following **EXCEPT**:
- A. release of Mg^{++} blockade of NMDA receptors
 - B. rapid development of larger excitatory postsynaptic potentials in CA1 neurons
 - C. activation of protein kinase C
 - D. depletion of dopamine release from Schaffer collateral axon terminals
 - E. activation of nitric oxide synthase
77. CREB1 and CREB2 are thought to be involved in memory consolidation. Which of the following statements about these CREBs is **FALSE**?
- A. CREB1 suppresses CREB2
 - B. CREB1 activates transcription from CRE
 - C. CREB2 must be inhibited to get CREB1 activation
 - D. CREB1 activation is needed to produce proteins needed for growth of new connections
 - E. increased PKA leads to phosphorylation of CREB1

78. The neural mechanisms by which memories switch from a short-term to a long-lasting state involves all the following **EXCEPT**:

- A. activation of CREB1
- B. decreased PKA activity
- C. production of ubiquitin hydrolase
- D. production of proteins that are needed for new synapses
- E. suppression of CREB2

79. Which of the following statements about forgetting is **FALSE**?

- A. long past events are more easily forgotten than very recent events
- B. amnesia is a reflection of normal forgetting
- C. forgetting is probably necessary due to limits in brain memory capacities
- D. forgetting involves neural processes which result in the loss or failure to retrieve information
- E. increased forgetting with age is probably related to losses of synapses and neurons and corresponding decreases in brain weight

80. Which of the following statements about treatments of memory loss in Alzheimer's disease is **FALSE**?

- A. no strategy or drug has proven to reverse the progression of Alzheimer's memory loss
- B. antioxidants have been tested to treat this disease
- C. glutamate receptor antagonists have been tested for treatment of this disease
- D. growth factors are the only FDA approved drugs for treatment of this disease
- E. one treatment is to increase central cholinergic activity

81. Which of the following is **NOT** associated with frontal lobe disease or injury:

- A. spastic hemiplegia
- B. anosmia with lesions of the orbital parts
- C. dysmusia or amusia
- D. motor (Broca's) speech disorder with agraphia
- E. loss of verbal associative fluency

82. A patient with traumatic brain injury of the temporal lobes might exhibit the following clinical findings **EXCEPT** :

- A. homonymous upper quadrantanopsia
- B. Wernicke's dysphasia or aphasia
- C. dysnomia or amnesic aphasia
- D. Kluver-Bucy-like syndrome
- E. All of the above may present with temporal lobe injury

83. A patient with chronic atrial fibrillation was unfortunately not anti-coagulated and suffered an embolic stroke. The patient became dizzy, and collapsed unconscious. When the patient awoke and was stabilized on the stroke unit, there was cortical blindness (Anton's Syndrome). This indicates a lesion or damage to which of the following:

- A. the non-dominant hemisphere(right) of the patient
- B. the right geniculocalcarine tract
- C. left parietal lobe dysfunction
- D. frontal lobe eyefields
- E. bilateral occipital cortex

84. Bilateral occipital cortex damage from basilar artery disease might include all of the following

EXCEPT:

- A. loss of perception of color
- B. prosopagnosia
- C. auditory delusions or hallucinations
- D. Balint Syndrome
- E. cortical blindness

85. A patient suffers a bleed from an arterio-venous malformation with extensive damage to the left or dominant parietal lobe. This might present with any of the following **EXCEPT:**

- A. bilateral ideamotor & ideational dyspraxia or apraxia
- B. tactile agnosia or bimanual astereognosis
- C. Gerstman Syndrome
- D. spastic pseudobulbar palsy(bulbar)
- E. disorders of language, especially dyslexia

86. Arrector pili muscles...

- A. are innervated by somatic motor neurons.
- B. contract in response to parasympathetic activity.
- C. are innervated by axons that pass through the grey communicating ramus.
- D. are innervated by axons that pass through the white communicating ramus.
- E. are not found in neck skin.

87. Parasympathetic innervation to the heart...

- A. speeds it up.
- B. slows it down.
- C. releases norepinephrine
- D. acts to decrease the time between cardiac impulses
- E. is provided by postganglionic neurons originating in the superior cervical ganglion.

88. Which of the following structures is NOT supplied by postganglionic neurons originating in the superior cervical ganglion?

- A. Iris constrictor.
- B. Lacrimal gland.
- C. Parotid gland
- D. Iris dilator.
- E. Submandibular gland.

89. The myenteric plexus...

- A. is also known as Auerbach's plexus.
- B. lies between the external longitudinal and circular smooth muscle layers of the gut.
- C. contains neurons that receive synaptic input from parasympathetic postganglionic axons.
- D. is part of the enteric nervous system.
- E. All of the above.

90. For postganglionic sympathetic neurons, name the major neurotransmitter receptor expressed on the cell surface, followed by the major type of neurotransmitter synthesized by the neurons.
- A. Glycine receptors, Gamma amino butyric acid (GABA)
 - B. Glycine receptors, Glycine.
 - C. Acetylcholine (muscarinic) receptors, Acetylcholine
 - D. Acetylcholine (nicotinic) receptors, Norepinephrine
 - E. Acetylcholine (nicotinic) receptors, N-methyl d-aspartate (NMDA)
91. Familial dysautonomia...
- A. is also known as Hirschprung's disease.
 - B. predominantly affects Native American children.
 - C. involves the loss of neurons in autonomic and sensory ganglia.
 - D. involves arteriolar constriction caused by cold or emotional shock.
 - E. None of the above.
92. Pain and pressure afferents from the gut...
- A. generally travel in parasympathetic nerves.
 - B. generally travel in sympathetic nerves.
 - C. may travel in the pelvic splanchnic nerve.
 - D. have their primary afferent cell bodies in the mesencephalic nucleus of cranial nerve V.
 - E. None of the above.
93. Which one of the fiber tracts listed below provides a major connection between amygdala and hypothalamus?
- A. Tuberohypophyseal tract.
 - B. Medial forebrain bundle.
 - C. Stria terminalis
 - D. Fornix.
 - E. Stria medullaris.
94. The following statements about the hippocampal formation are true **EXCEPT**...
- A. The major output from the hippocampal formation is to entorhinal cortex.
 - B. The precommissural fornix carries subiculum axons to the mammillary body.
 - C. Since the hippocampus does not appear to play a role in controlling emotions, neuroscientists no longer consider it part of the limbic system.
 - D. Both the hippocampus and the dentate gyrus are composed of 3 cortical layers.
 - E. The major input to the hippocampus is from entorhinal cortex.
95. Experiments by LeDoux and colleagues involving the amygdala in animals and/or humans indicate...
- A. a role for the amygdala in the formation of declarative memories.
 - B. the amygdala is a "reward center", a site in which electrical stimulation serves as a strong positive reinforcement for learned behavior.
 - C. a role for the amygdala in sexual arousal.
 - D. a role for the amygdala in integrating fear-like behaviors.
 - E. reciprocal connections between amygdala and thalamus.

Case study 1 (this study refers to the 2 questions immediately following).

A 50 year old man who was homeless and alcoholic was admitted to the emergency room. His problem had begun about 2 years earlier with tingling sensations in both feet. Over time these sensations developed into burning pains and numbness in both feet. More recently, he had experienced similar tingling sensations in the fingers of both hands. The man appeared emaciated. A neurological exam revealed:

1. Diminished touch and pain sensitivity on both feet, the distal third of both legs, both hands, and parts of both forearms.
2. Palpation of the soles of both feet and both calf muscles evoked abnormally strong pain sensations.
3. Ankle reflexes were slow and limb musculature appeared atrophied.

96. The bilateral sensory signs of this case are consistent with nervous system disease in which area?

- A. spinal cord
- B. medulla
- C. peripheral nerve(s)
- D. cerebellum
- E. internal capsule

97. As the ER attending physician, what is your first course of action?

- A. administer glucose and B vitamins
- B. order a cranial MRI
- C. order a cranial CAT scan
- D. perform a spinal tap (lumbar puncture)
- E. counsel the patient about his problem with alcohol

Case study 2 (this study refers to the 5 questions immediately following).

A 58-year-old man suddenly developed (1) dizziness and (2) right facial pain. Neurologic examination found (3) nystagmus during right lateral gaze, (4) ataxia on the right, (5) loss of pain and temperature sensation over the right side of the face and also (6) on the left trunk and extremities, (7) loss of corneal reflex on the right, and (8) falling to the right when trying to stand with eyes closed (Romberg test). Angiography showed considerable arteriosclerosis of the vertebral-basilar arterial system.

98. Of the numbered signs and symptoms, how many relate directly to damage of vestibular nuclei (including MLF) or cerebellum (including the cerebellar peduncles)?

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

99. What structure is common in the pathways involved in symptoms #5 and #7?

- A. anterolateral (spinothalamic) tract
- B. principle sensory (trigeminal) nucleus
- C. facial nerve
- D. Edinger-Westphal nucleus
- E. spinal trigeminal nucleus

100. Except for #6, all the other symptoms lateralize to right side. Why is #6 different in this respect?

- A. Dr. Mooney commonly makes errors like this (remember, you must pick the **BEST answer**).
- B. axons from left side dorsal horn cells cross over to the right anterolateral tract as they ascend
- C. the medial lemniscus decussates in the lower medulla
- D. the pyramidal tracts decussate in the lower medulla
- E. the superior cerebellar peduncles decussate in the midbrain

101. When the patient attempts to look to the left, and in doing so, shows jerkiness or oscillations of the eyes (symptom #3, a pathological nystagmus), what structure(s) is(are) involved in this sequence of events?

- A. superior colliculus and/or prefrontal (cortical) eye fields
- B. abducens nucleus
- C. oculomotor nucleus
- D. medial longitudinal fasciculus (MLF) and vestibular or cerebellar nuclei
- E. all the above play some role

102. Which artery most likely sustained the (presumed) infarct?

- A. vertebral artery
- B. posterior inferior cerebellar artery
- C. anterior inferior cerebellar artery
- D. superior cerebellar
- E. basilar artery

Case study 3 (this study refers to the 3 questions immediately following).

History A 60-year old woman first noted "numbness", as she described it, of all fingers of the right hand 2 1/2 years ago. Clumsiness of the right hand developed shortly thereafter. Defective appreciation of temperature with the right hand had been noted 1 1/2 years ago; and 7 months prior to her admission, a similar numbness of all fingers of the left hand developed. At the same time, a stiffness of both lower extremities was noted, accompanied by an unsteadiness on rapid turning.

Physical examination

(1) The mental status and cranial nerves were intact. (2) Fasciculations and a minor degree of atrophy were present in muscles of both shoulders. (3) Fasciculations were not present in the lower extremities. Strength was decreased bilaterally as follows: (4) moderate weakness in shoulder abductors and elbow flexors and extensors. There was a (5) marked weakness of intrinsic hand muscles. (6) The lower extremities had minimal weakness. (7) Spasticity was noted on passive motion in the lower extremities and her gait was spastic. (8) The triceps, quadriceps, and Achilles reflexes were increased bilaterally. (9) Plantar responses were extensor bilaterally (Babinski sign). (10) Pain and temperature were decreased at the C4 to T1 segments bilaterally, with total loss in her right hand and lower arm. (11) In these segments, touch sensation was intact.

103. Fasciculations and atrophy (symptoms #2 of neurological examination) are indicative of...

- A. peripheral nerve demyelination or injury
- B. anterior horn damage
- C. ventral root damage
- D. "lower motor neuron" disease
- E. all of the above

104. What is the connection between the loss of pain and temperature sensation in dermatomes C4-T1 (symptom #10) and the progressively increased weakness in muscle groups from symptoms #6 (minimal weakness) to #4 (moderate weakness) to #5 (marked weakness)?

- A. leg muscles are normally stronger than upper arm than hand muscles, so there is no correlation of body region and disease process that is similar to that for the sensory symptoms in #10
- B. the similar somatotopy (the homunculus) of sensory and motor cortex explains the similar motor and sensory findings
- C. damage in anterior spinal cord for dermatomes C4-T1 would interrupt anterolateral (spinothalamic) axons as they cross the midline and also would most severely affect motor neuron pools controlling wrist and hand muscles
- D. damage in the diencephalon involving the internal capsule would disrupt afferent and efferent fiber systems, which could result in these patterns of loss of function.
- E. damage in the anterior medulla, which affects the anterolateral tract and the pyramidal tract, would produce the sensory and motor symptoms.

105. How many of numbered symptoms in the neurological exam are **EXCLUSIVELY** indicative of "upper motor neuron" disease? Note that in some cases a single number identifies a group of similar symptoms, and such a group would only count once.

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

FINAL EXAM VERSION 2

- | | | |
|------------------------|-----------------|---------------|
| 1. A. | 43. D. | 85. D. |
| 2. E. | 44. A. | 86. C. |
| 3. A. | 45. A. | 87. B. |
| 4. E. | 46. C. | 88. A. |
| 5. D. | 47. C. | 89. E. |
| 6. B. | 48. B. | 90. D. |
| 7. C. | 49. C. | 91. C. |
| 8. B. | 50. D. | 92. B. (or C) |
| 9. E. | 51. E. | 93. C. |
| 10. A. | 52. D. | 94. B. (or C) |
| 11. C. | 53. C. | 95. D. |
| 12. D. | 54. D. | 96. C. |
| 13. E. | 55. B. | 97. A. |
| 14. C. | 56. D. | 98. D. |
| 15. B. | 57. A. | 99. E. |
| 16. E. | 58. B. | 100. B. |
| 17. B. | 59. D. | 101. E. |
| 18. C. | 60. C. | 102. B. |
| 19. D. | 61. D. | 103. E. |
| 20. C. | 62. B. | 104. C. |
| 21. B. | 63. C. | 105. C. |
| 22. D. | 64. D. | |
| 23. A. | 65. E. | |
| 24. D. | 66. D. | |
| 25. E. | 67. C. | |
| 26. E. | 68. A. | |
| 27. B. | 69. C. | |
| 28. A. | 70. E. | |
| 29. A. | 71. E. | |
| 30. C. | 72. C. | |
| 31. A. | 73. C. | |
| 32. E. | 74. D. | |
| 33. D. | 75. E. | |
| 34. E. | 76. D. | |
| 35. B. | 77. A. | |
| 36. A. | 78. B. | |
| 37. C. | 79. B. | |
| 38. E. (also accepted) | 80. D. | |
| 39. C. | 81. C. | |
| 40. B. | 82. E. | |
| 41. A. | 83. E. | |
| 42. B. | 84. C. (also B) | |